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ABSTRACT

The 1990s have seen change in the populations of graduate students in physics departments across the country. The Graduate Student Survey captures demographic characteristics of approximately 10,600 physics and astronomy students who were enrolled in the 1996-97 academic year. It describes the students' sources of support, areas of specialization, country of origin, and years of study for those receiving degrees. The paper discusses the results in light of the decline of total enrollment in U.S. physics graduate departments over the past decade. First-year enrollment has declined in the last decade and is expected to continue to decline over the next decade. The enrollment decline has been steeper for U.S. students than for foreign students. Foreign students now make up 45% of the physics graduate student population. Support for graduate students in physics and astronomy varies by department. Years of study averages 6.1 for students receiving doctorates. Foreign students are higher in numbers in physics than astronomy, and the number of women in physics is less than the number of women in astronomy. The report includes tables and summaries of major findings. (HB)

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May 1999

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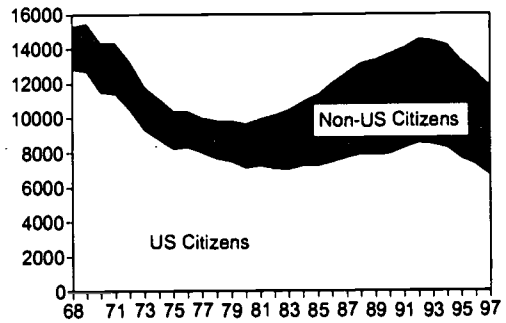
Figure 1. Total number of students enrolled in US physics graduate programs, 1968-1997.



Note: Non-US citizens include those students with permanent resident status as well those with temporary visas. Graph includes students enrolled on a part-time basis.

Source: Data AIP Enrollments and Degrees Survey.

The Decade of the 1990s has been remarkably volatile for physics and related disciplines. One such example has been the significant changes in both the number and composition of students enrolled in US physics and astronomy graduate programs. This report describes the population of physics and astronomy students enrolled during academic year 1996-97 as well as their sources of support, areas of specialization, country of origin and years of study for those receiving degrees.

Total enrollment in US physics graduate departments continues to decline. There were 11,786 graduate students enrolled in the 261 US physics graduate departments during the 1996-97 academic year. This represents a 6% drop from the previous year and a cumulative drop of 19% from the recent high in 1992. With the declines experienced in first-year enrollments in recent years, overall enrollments will continue to decline for several more years. The decline has been steeper for US students (27%) than for foreign students (15%). As a result, foreign citizens now make up 45% of the physics graduate student population **(Figure 1)**.

Table 1. The physics and astronomy graduate student population*, academic year 1996-97.

	Physics graduate students	Astronomy graduate students
First year of study	2404	155
2nd + Year of study	7208	542
Received Master's**	789	23
Received PhD	1385	117
Student Total	11786	837
Number of Depts.	261	46

* Data from Enrollments and Degrees Report.

** Does not include master's who received an enroute degree.

Source: AIP 1997 Graduate Student Report.

Table 2. Characteristics of physics graduate students, 1996-97

	%
Citizenship	
US*	55
Non-US*	45
Permanent Resident	11
Temporary Visa	89
Racial & Ethnic Background**	
White	89
East Asian	4
Hispanic	2
African-American	2
Asian Indian/South Asian	1
Other/Mix	2
Type of institution where graduate students who were physics under-graduates earned bachelor's degrees	
PhD-granting	43
Master's-granting	4
Bachelor's-granting	21
Foreign institution	32

*Data from the survey of Enrollments and Degrees. ** US citizens only.

Source: AIP 1997 Graduate Student Report.

Table 3. Region/country of origin of physics graduate students who were not US citizens, 1996-97 .

	%
People's Republic of China	21
Western Europe	16
Former Soviet Union	12
Central Europe	10
India	7
South Korea	5
Taiwan	5
Other Asia	8
Middle East	5
Mexico, South & Central America	5
Canada, Australia	4
Africa	2

Source: AIP 1997 Graduate Student Report.

Table 4. Subfield for graduate students with 3+ years of study at physics PhD-granting departments, 1996-97.

	%
Condensed Matter	18
Particles and Fields	15
Astronomy & Astrophysics	13
Nuclear Physics	7
Atomic & Molecular	6
Optics & Photonics	6
Atmospheric, Space Physics & Cosmic Rays	4
Plasma & Fusion Physics	4
Surface Physics	3
Materials Science	3
Biophysics	3
Relativity & Gravitation	3
Applied Physics	2
All other subfields	13

Source: AIP 1997 Graduate Student Report.

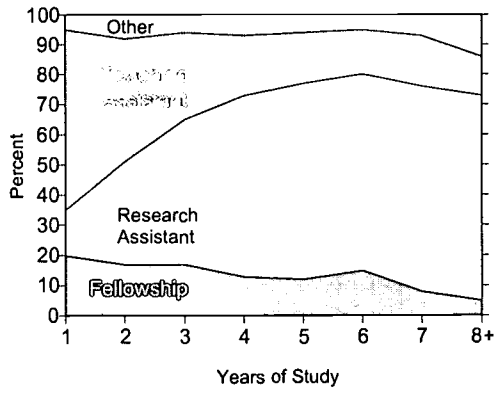
- There were 837 graduate students enrolled in the 46 astronomy graduate departments in the US during the 1996-97 academic year, 155 of whom were in their first year of study **(Table 1).** Enrollments in graduate astronomy departments have declined 11% since the recent high in academic year 1992-93.

- While the proportion of physics graduate students who are foreign citizens has been increasing in recent years, the composition of these students has also been changing. The proportion of foreign students from the former Soviet bloc countries has been on the rise, while the proportion of students from the People's Republic of China has been declining. The People's Republic of China has been and continues to be the single largest source of foreign physics graduate students since the mid 1980s. **(Table 3)**

- About one-quarter of the beginning graduate students who were US-citizens had taken a year or more off between receiving their bachelor's degrees and enrolling in a graduate physics program.

- Condensed matter continues to be the most popular primary subfield of study for advanced physics graduate students (18%). In 1996-97, as in the past, about two-thirds of all the upper-level graduate students indicated their research method was experimental **(Table 4).** Foreign citizens have historically had a higher proportion indicating their primary research method to be theoretical than the students with US citizenship; in 1996-97 the proportions were 39% and 25% respectively.

Figure 2. Financial support for physics doctoral students enrolled at PhD-granting institutions by years of study, 1996-1997.



Source: AIP 1997 Graduate Student Report.

Table 5. Source of support for physics graduate students enrolled at master's degree-granting institutions, 1996-97.

	Full-time Students %	Part-time Students %	All Students %
Teaching Assistantship	72	13	56
Research Assistantship	12	2	10
Fellowship	4	-	3
Family, Savings, Loan	6	35	14
Employment	3	44	14
Military	1	4	2
Other	1	2	1

Source: AIP 1997 Graduate Student Report

- Although students enrolled in graduate physics programs continue to be well supported, support does vary by the type of program in which the student is enrolled **(Figure 2)**. Only 4% of the students at doctoral departments indicated they needed to rely upon personal savings, loans or non-departmental employment as their primary source of financial support. The support picture at the master's-granting departments is quite different. Students at master's departments, in contrast, generally have a much smaller research component to their graduate work, and are more likely to be enrolled on a part-time basis, 26% versus 4% at the doctoral departments. As a result, a larger proportion (28%) need to rely on their personal finances or are employed outside the department **(Table 5)**.

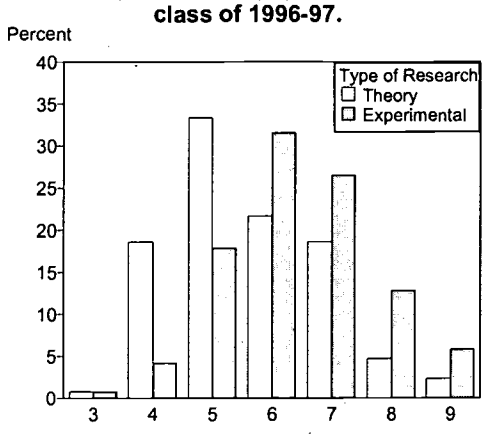
- There were 1,385 physics doctorates and 789 master's exiting from US graduate physics departments in the class of 1996-97. Both doctorate and master's degree production has been declining in recent years, a trend that is likely to continue given present enrollment figures. The AIP *Enrollments and Degrees Report* discusses physics and astronomy enrollments and degree production for all degree levels, and is available from our Web site at: (www.aip.org/statistics/trends/trends.htm).

- Physics doctorate recipients took an average of 6.1 years of full-time-equivalent (FTE) years of study to earn their degrees. About 10% of the class of 1997 earned their degrees in four or fewer years while 15% took 8 or more years. Degree recipients with foreign citizenship generally report shorter times to degree than their US counterparts. **Figure 3** illustrates FTE for PhD recipients divided by their primary research method. Theoreticians on the whole take less time to earn their degrees than experimentalists, averaging 5.6 and 6.4 years respectively.

- As has been true in the past, foreign citizens have a higher representation and women have a lower representation among physics degree recipients than those receiving astronomy degrees **(Table 7 & 8)**. Physics is by far the most common undergraduate major for students receiving graduate level degrees in physics and astronomy.

- The AIP *Initial Employment Report* covers issues concerning post-degree plans and initial employment for physics and astronomy degree recipients at all degree levels. This report and many other reports concerning the physics and astronomy community can be found on our Web site: (www/aip.org/statistics).

Figure 3. Full-time equivalent (FTE) years of study for PhDs by type of research, class of 1996-97.



Source: AIP 1997 Graduate Student Report

Table 6. Subfield characteristics for students enrolled in astronomy graduate departments, 1996-97.

Subfield of Study	%
Extragalactic	17
Solar system & Space physics	10
Stellar evolution	10
Active galaxies & Quasars	9
Normal galaxies	8
Stars	7
Cosmology	6
Other	33

Source: AIP 1997 Graduate Student Report.

Table 7. Background characteristics of astronomy degree recipients, class of 1996-97.

	PhD Recipients %	Master's Recipients %
Citizenship* US	73	83
Non-US	27	17
Sex* Male	81	70
Female	19	30
Median Age	29	**
Median years of full-time equivalent graduate study	6	**
Major of bachelor's degree		
Physics	76	**
Astronomy	22	**
Other	2	**

Note table does not include master's who received enroute degrees

* Data from Enrollments and Degrees Report.

** There were 23 exiting master's in the class of 1996-97 of whom only 7 responded to our survey.

Source: AIP 1997 Graduate Student Report.

Table 8. Characteristics of physics degree recipients, class of 1996-97.

	PhD %	Master's %
Citizenship* US	55	64
Non-US	45	36
Sex* Male	88	82
Female	12	18
Age <= 26	6	42
27-28	25	19
29-30	29	10
31-32	17	8
33+	23	21
Major of bachelor's degree		
Physics	93	82
Engineering	4	6
Mathematics	2	4
Other	1	8

*Data from the Enrollments and Degrees Report.

Note: Data on Master's Degree Recipients exclude those who received an enroute degree.

Source: AIP 1997 Graduate Student Report.

Endnote: The Graduate Student Survey was mailed to approximately 10,600 physics and astronomy students who were enrolled during the 1996-97 academic year and for whom departments supplied addresses. The survey consisted of three mailings, the first of which went out in May of 1997. We received usable data from approximately 35% of the known population of students enrolled during the 1996-97 academic year.

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